

Linear Combinations

Given vectors $\mathbf{v}_1, \mathbf{v}_2, \dots, \mathbf{v}_p \in \mathbb{R}^n$, and scalars c_1, c_2, \dots, c_p , the vector \mathbf{y} where

$$\mathbf{y} = c_1\mathbf{v}_1 + c_2\mathbf{v}_2 + \dots + c_p\mathbf{v}_p$$

is called a linear combination of $\mathbf{v}_1, \mathbf{v}_2, \dots, \mathbf{v}_p$ with the weights c_1, c_2, \dots, c_p .

This is also called a vector equation.

$$c_1 - c_2 = 1$$

$$c_1 + c_2 = 3$$

$$0c_1 + 0c_2 = 1$$

We need c_1 and c_2 such that:

$$c_1 \begin{bmatrix} 1 \\ 1 \end{bmatrix} + c_2 \begin{bmatrix} -1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

So,

$$\begin{bmatrix} c_1 \\ c_1 \end{bmatrix} + \begin{bmatrix} -c_2 \\ c_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

So finally,

$$c_1 - c_2 = 1$$

$$c_1 + c_2 = 3$$

Same question, can \mathbf{y} be represented as a linear combination of \mathbf{v}_1 and \mathbf{v}_2 :

$$c_1 \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + c_2 \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix}$$

$$c_1 - c_2 = 1$$

$$c_1 + c_2 = 3$$

$$0c_1 + 0c_2 = 1$$

Thus, the system is **inconsistent** (no consistent).